CHOLINESTERASE MONITORING FOR AGRICULTURAL PESTICIDE HANDLERS

GUIDELINES FOR HEALTH CARE PROVIDERS IN WASHINGTON STATE

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Modeled on the California "*Guidelines for Physicians who Supervise Workers Exposed to Cholinesterase-Inhibiting Pesticides."* Portions used with permission from: Robert Schlag, M.Sc., Chief Pesticide Epidemiology Unit Office of Environmental Health Hazard Assessment; 1001 I Street, 12th Floor; Sacramento, CA 95814

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Contents

Overveiw

Washington Administrative Code (WAC) 296-307-148 establishes a medical monitoring program designed to detect overexposure to organophosphate (OP) and N-methyl-carbamate cholinesterase-inhibiting pesticides. The rule applies to all agriculture employers and employees covered by chapter 296-307 WAC, which includes the pesticide Worker Protection Standard, WAC 296-307-107. To comply with this new rule, employers, employees, physicians and other licensed health care providers (clinicians), and the Department of Labor & Industries (L&I) have certain responsibilities.

Employers must:

- Implement a monitoring program for employees who, as part of their job duties, handle toxicity Categories I or II OP or N-methyl-carbamate pesticides with the signal words, "Danger" or "Warning" on the label.
- Follow all occupational health recommendations from the clinician.
- Provide employee training on the health hazard of cholinesterase-inhibiting pesticides and the purpose and requirements for medical monitoring.
- Make sure copies of employee test results and clinician written recommendations are maintained for seven years.

Clinicians must:

- Discuss the risks and benefits of participation in the cholinesterase-testing program with the employee.
- Obtain a signed declination if the employee chooses not to participate in the program.
- Provide and interpret baseline and periodic testing of blood cholinesterase levels.
- Provide written occupational health recommendations as indicated in the rule
- Perform an initial intake exam, including a medical history (recommended.)
- Assess other conditions that may affect the patient's cholinesterase levels

L&I must implement and evaluate the rule, including:

- Collecting data.
- Reviewing stakeholder input.
- Distributing provider guidelines.
- Modifying the rule as appropriate.

Employees must be:

- Informed about the Rule.
- Instructed in the health hazards of OP and N-methyl-carbamate pesticides.
- Given the chance to freely and willingly consent or decline to participate in the program.

This manual is written to help clinicians become active participants in this program. It presents background information, practical suggestions, and tools to help facilitate participation.

Cholinesterase monitoring clinical consultation services are available 24 hours a day through the University of Washington Occupational Medicine Residency Program at (206) 341-4446. Dr. Matthew Keifer may also be contacted at (206) 616-1452

Cholinesterase medical monitoring algorithm*

Grower identifies employees likely to meet monitoring threshold
Grower contacts medical provider and arranges testing

↓

Grower sends handler for ChE testing

↓

Medical provider evaluates and explains testing to handler

↓ ↓

Employee gives informed consent | Employee refuses, signs declination → no testing

↓

Baseline plasma and RBC cholinesterase testing through Public Health Laboratory

↓

Employee handles ≥50 hours in 30 days OR testing done on routine 30 day schedule

↓

Periodic cholinesterase test done and report received

↓ ↓ ↓

ChE 80% or more of baseline | ChE < 80% > 69% of baseline | RBC ChE ≤70% of baseline OR plasma ChE ≤60% of baseline

↓ ↓ ↓

No action | Work Practice evaluation | Employee removed from exposure

↓

Follow-up testing

↓

ChE levels ≥80% or greater of baseline

↓

Employee returned to handling

Employee has symptoms of pesticide poisoning

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Refer for further evaluation as appropriate, report to DOH (See Notifiable Conditions http://www.doh.wa.gov/notify/nc/pesticide.htm)

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* Input from Lisa Conner, Manager KGH Occupational Health and Pam Striplin, ARNP

Cholinesterase Monitoring

What is cholinesterase?
Cholinesterase (ChE) is the general term for two enzymes in the human body: acetylcholinesterase or red blood cell cholinesterase (AChE) and butyrylcholinesterase or plasma cholinesterase (PChE). Both enzymes can be measured in the blood and have a wide range of normal in human populations (inter-individual variability). However, an individual's personal baseline will show much less variability. Thus, in order to be able to accurately assess whether a person has been overexposed to ChE-inhibiting pesticides, a baseline should be obtained and subsequent values must be compared to the baseline.

Organophosphate and N-methyl-carbamate pesticides

What are these pesticides?
Organophosphate (OP) and N-methyl carbamate pesticides are insecticides, which cause toxicity both in the pest and in non-pest species (such as humans) by inhibiting acetylcholinesterase (AChE). AChE is the enzyme responsible for removing the neurotransmitter acetylcholine from the neuronal synapses. OP pesticides inhibit cholinesterase by binding irreversibly to the active site of the enzyme. N-methyl-carbamates bind reversibly to the enzyme and interfere with its function. AChE acts to "turn off" the neurological signal delivered by cholinergic nerves. Thus if AChE is inhibited, acetylcholine builds up causing over-stimulation of cholinergic systems. This over-stimulation of muscles, glands and other nerves is what causes most of the symptoms associated with overexposure to these compounds. OP and N-methyl-carbamates are among the most toxic substances produced by modern chemical technology. Aldicarb (an N-methyl- carbamate still widely used) for example has an oral LD_{50} (lethal to 50% of test animals) of 1 mg per kilogram.

How are they used?
The way these pesticides are used depends largely on the crop to which they are being applied. In orchards, a common method for application is the airblast sprayer. This method is used both for pesticides and nutrients. Aircraft, either helicopters or airplanes, may at times apply these chemicals. At other times an employee using a backpack sprayer applies them. For some field crops such as potatoes a granulated pesticide product may be applied using a dispenser pulled by a tractor.

How do overexposures occur?
Pesticides most commonly enter the body through direct contact. Most exposure to pesticides that employees receive is through the skin. Skin or eye contact with spray while applying or with concentrate while mixing are the most commonly reported pathways of exposure. Cholinesterase inhibitors can be absorbed across the lungs if inhaled. Most of these chemicals are easily noticed by their strong and disagreeable smell, and employees must wear cartridge respirators when handling some of these products. Although many of the cholinesterase inhibitors presently on the market have rather low volatility, handlers must avoid exposure to spray mists produced by the application equipment. Ingestion, except by intention, is rarely a mechanism of employee exposure.

What is the mechanism of illness?
Illness is produced by cholinesterase inhibition at the level of the neuronal synapse. This leads to over stimulation of the glands, muscles, and nerves innervated by cholinergic neurons. Monitoring of pesticide-related illnesses has also documented that a number of employees report mild symptoms such as nausea, dizziness, and headache that appear without obvious cholinesterase depression. These symptoms are usually transient and may be due to the methyl-mercaptans or other ingredients in the products.

Cholinesterase testing

What does the cholinesterase test measure?
Sampling the cholinesterase enzyme activity in the blood is a convenient biomarker that reflects the activity of acetylcholinesterase at the synapse. There is no other practical way to non-invasively measure the actual neuronal cholinesterase activity level at the synapse. The blood test is a kinetic assay that measures the production of a colorant by the action of the enzyme in the test sample. By periodically comparing measurements of cholinesterase activity to a subject's established baseline (prior to pesticide exposure), episodes of overexposure can be identified before the occurrence of clinical illness. An appropriate testing schedule is intended to detect overexposure before the occurrence of clinical illness.

Note: Plasma cholinesterase can be determined on either plasma or serum. Serum is what is drawn off after blood is clotted and spun down in a centrifuge. The absence of clotting factors from serum (the difference between serum and plasma) does not materially affect the assay. Please note, that the Department of Health laboratory ***requests serum*** *to measure plasma cholinesterase; when possible specimens should be clotted, spun down, and serum drawn off for shipping.*

Why must baseline levels be established?
It is essential to establish an individual's baseline value for both plasma and RBC cholinesterase activity in order to interpret subsequent results. Since there is a fourfold difference between the upper and lower limits of a laboratory "normal population range," the normal range cannot be relied upon for exposure monitoring. Baseline determinations must be established at least 30 days since the employee last handled organophosphate or N-methyl-carbamate pesticides. The rule allows for a "working baseline" to be obtained for employees who initially decline testing but later choose to participate.

What tests do I order?
Laboratory testing of cholinesterase levels has definite limitations and must be used with the following qualifications:

Use of approved laboratories
A laboratory performing cholinesterase tests as part of medical supervision must be approved by L&I and shall have a quality control program and an analytical method acceptable to that department. Through 2005, only the Washington State Department of Health Public Health Laboratory (DOH-PHL) is approved by L&I.

Note*: The ChE tests conducted at DOH-PHL are for purposes of routine monitoring and subsequent follow-up of ChE depression. It is preferable that all tests be done through the DOH-PHL. However, DOH-PHL services are only available during normal business hours, not on weekends or holidays. If a situation occurs where ChE test turn around is required in fewer than five days (e.g., medical management of an acute, symptomatic exposure) the normal channels for laboratory testing used by your clinic should be followed. Subsequent ChE tests to monitor recuperation may be submitted to the DOH-PHL.*

Plasma and RBC Cholinesterase
Both plasma (or serum) and RBC cholinesterase must be determined on each sample tested because the two tests have different meanings and the results need to be considered in combination for proper

interpretation. Certain organophosphates exhibit preferential inhibition of either plasma or RBC cholinesterase activity.

Plasma cholinesterase, or "pseudo-cholinesterase," is more labile than RBC cholinesterase and is thus less reliable in reflecting actual enzyme depression at neuro-effector sites. It generally responds (e.g., is inactivated more rapidly) after exposure to organophosphates, but it may also be depressed by other factors such as heavy alcohol intake, infection, and hepatic disease. Since plasma cholinesterase is produced in the liver, it can be regenerated relatively quickly. After mild overexposure there is sometimes a rebound phenomenon resulting in slightly elevated levels.

RBC cholinesterase, or "true cholinesterase," is biochemically the same enzyme as the acetylcholinesterase located at the neuro-effector cell synapses. It is considered a more accurate measure of the actual acetylcholinesterase activity level at the neuro-effector sites. This enzyme is often depressed more slowly than plasma cholinesterase by exposure to organophosphates. Regeneration of RBC cholinesterase is slower and is generally measured at the rate that new red blood cells are produced, slightly less than 1% per day.

Results of cholinesterase activity tests must be interpreted by a clinician.

Setting up a Monitoring Program

Which employees must be monitored?
Agricultural employees who handle toxicity Category I or II organophosphate or N-methyl-carbamate pesticides for 50 or more hours in any consecutive 30-day period come under the regulation for cholinesterase monitoring during 2004. In 2005 the exposure threshold will be 30 hours in any consecutive 30-day period. Pesticide handling activities include, but are not limited to loading, mixing or applying pesticides or assisting in such activities (see the definition of handling WAC 296-307-11005).

What do I do at the first visit?
At the initial visit of the employee, the clinician should take a pre-exposure history and may conduct a focused physical examination, including pertinent identifying, occupational, and medical information.

What other medical conditions need to be evlauated?

Because individuals with significant respiratory, hepatic, or cardiovascular impairment face special risks in jobs requiring exposure to cholinesterase inhibitors, the clinician should obtain a brief medical history. The clinician should also inquire about a history of conditions that, may be adversely affected by cholinergic reactions, such as active peptic ulcer or bronchial asthma.

Other conditions in which complications may be anticipated include anemia, degenerative diseases of the central nervous system, chronic colitis, history or evidence of psychosis, and diseases such as myasthenia gravis and glaucoma, which are treated with cholinesterase inhibitors. About 1-3% of the population carries a polymorphism for congenitally low plasma cholinesterase. These employees will have abnormally low plasma cholinesterase activity on assay in the absence of cholinesterase inhibitors. This deficiency of activity is generally not thought to affect susceptibility to organophosphate or N-methyl-carbamate pesticides. Some scientists suggest that this deficiency may decrease the number of sites of potential binding of cholinesterase inhibitors and thus may increase the direct effect of inhibitors on the target acetylcholinesterase.

How do I interpret periodic test results?

The frequency of periodic follow-up cholinesterase tests is primarily a medical decision although the Washington State regulations require minimum intervals (see Rule Section 296-307-14810). Factors to consider are workplace conditions, pesticide toxicity, duration of exposure, and employee hygiene

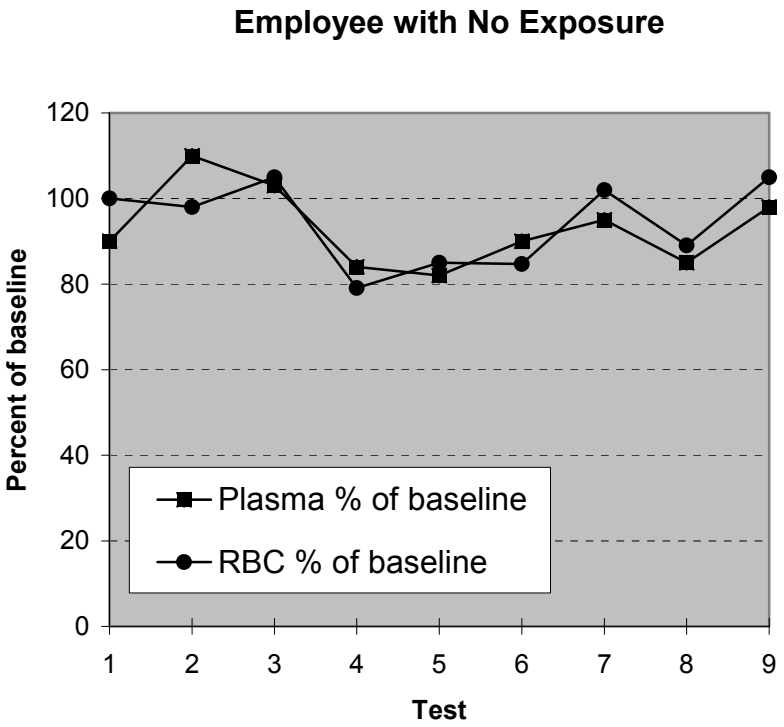
First, the clinician needs to calculate the percentage change from baseline. The calculation should be done separately for RBC cholinesterase and plasma cholinesterase. Mathematically, the percentage change from baseline is ((X-Y)/X)*100, where X is the baseline value, and Y is the follow-up value. The ChE rule uses percent inhibition (e.g., "20% below baseline"). So the result of the percentage change from baseline calculation is subtracted from 100% to obtain % of baseline.

Next, the clinician needs to review the differential diagnosis, in order to determine whether a pre-existing condition, unrelated to pesticide exposure, may be causing an abnormal cholinesterase value, as described above.

Figure 1 shows two charts illustrating hypothetical monitoring data for two employees. The first chart shows an employee with no significant exposure and; the second, reflects an employee with overexposure. *Note: the random fluctuations of the two values. Plasma and RBC cholinesterase activity levels are shown as a percentage of the workers' baselines.*

The key threshold values that require action are: ChE levels below 80% of baseline indicates a need for prompt retesting and notification for the employer to search for breaks in the Worker protection program; RBC ChE level $\geq$70% or plasma ChE level $\geq$60% from baseline calls for immediate removal of the employee from all exposure to OP and N-methyl-carbamate pesticides.

In the second chart, removal of the overexposed employee from exposure after Test 5 resulted in a return to baseline values.



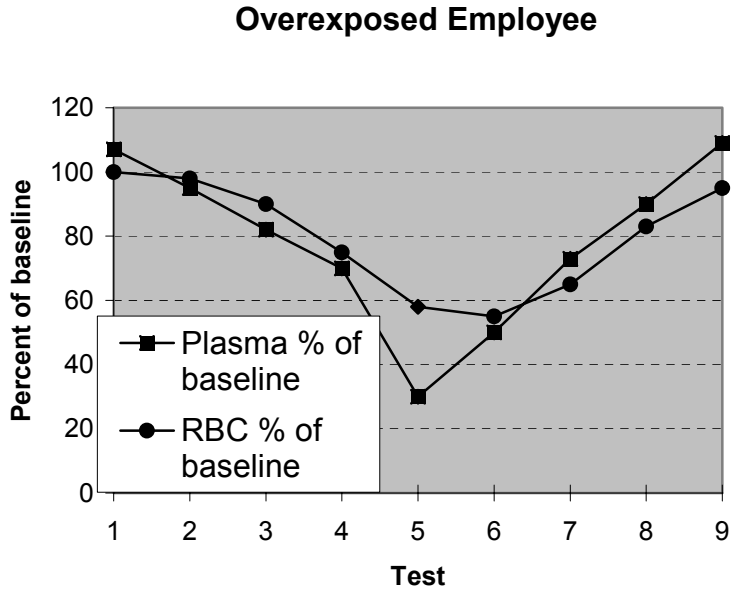


Figure 1. Illustrative cholinesterase monitoring charts. Data are shown for hypothetical tests taken at prescribed intervals. In the lower chart, the rise in both the plasma and RBC cholinesterase values following Test 5 reflects removal of the worker from continued exposure.

What happens if the cholinesterase level is depressed?
Cholinesterase limits have been set at levels that will indicate overexposure. These limits allow an adequate margin of safety; i.e., set at levels not likely to be associated with toxic manifestations. The margin of safety is especially important in the case of cholinesterase

inhibitors because of the insidious onset and nonspecific nature of early symptoms in cases of chronic exposure. Washington State regulations are outlined in the following table.

Table 1 - Required Responses to an Employee's Depressed Cholinesterase Levels

When:	Action to be taken:	Methods:
An employee's RBC or plasma cholinesterase levels fall more than 20% below the baseline	Evaluate the employee's work practices to identify and correct potential sources of pesticide exposure	Review with the employee: • Personal protective equipment (PPE) and its condition • Employees' PPE usage • General sanitation practices and availability of decontamination facilities required by WAC 296-307-13050 • Pesticide handling practices
An employee's RBC cholinesterase level falls 30% or more from the baseline. **OR** An employee's plasma cholinesterase level falls 40% or more from the baseline	Remove the employee from handling and other work exposures to organophosphate and N-methyl-carbamate pesticides such as thinning and harvesting in recently treated areas **AND** Evaluate the employee's work practices to identify and correct potential sources of pesticide exposure	• When available; provide the employee with other duties that don't include handling and other work exposures to organophosphate and N-methyl-carbamate pesticides • Provide medical monitoring and cholinesterase testing as recommended by the clinician
A removed employee's cholinesterase levels return to 20% or less below baseline	The employee may return to handling class I and II organophosphate and N-methyl-carbamate pesticides	Continue periodic cholinesterase monitoring

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 03-24-105 (Order 02-05), § 296-307-14825, filed 12/03/03, effective 02/01/04].

Table 1. The rule requires the employer to investigate work practices, including a review of the safety equipment used and its condition, employee sanitation, pesticide handling procedures, and equipment usage, whenever an employee's cholinesterase, either plasma or RBC, falls below 80% of baseline. The employer is then required to maintain a written record of the findings, any changes in equipment or procedures, and any recommendations made to the employee.

What happens if the employee is temporarily removed from exposure?
The employer should assign an employee to other duties while temporarily removed from exposure to cholinesterase-inhibiting pesticides. The rule requires the employer to provide medical removal protection benefits for a maximum of three months on each occasion that an employee is temporarily removed from exposure, whether assigned to other duties or removed from work. Removal benefits include maintenance of the same pay, seniority, and other employment rights and benefits of an employee as though the employee had not been removed.

Removal from exposure means restriction from any handling activities as defined in WAC 296-307-11005, avoidance of areas where OP or N-methyl carbamate materials are handled or mixed and avoidance of any contact with opened containers or with equipment that is used for mixing, dusting, spraying, or otherwise applying pesticides. This restriction includes cleaning or repair of mixing or application equipment. In addition to handling activities, the removed employee should be kept from exposure to OP and N-methyl carbamate residues.

When employees have been removed from exposure because their cholinesterase activity has fallen below the acceptable limits, the worker should not be returned to handling cholinesterase-inhibiting pesticides until enzyme activity levels have returned to 80% or greater of the baseline value for both plasma and RBC cholinesterase.

The employer is required to maintain, for seven years, written records of the dates of removal and the dates when the employee returned to handling OP and N-methyl-carbamate pesticides.

What is the schedule for periodic and follow-up testing?
Baseline testing must be done at least 30 days since last exposure to cholinesterase-inhibiting pesticides. Periodic cholinesterase testing should be done during the active season when employees handle toxicity Category I or II OP and N-methyl-carbamates for 50 hours or more in any consecutive 30-day period and then 30 hours or more in any consecutive 30-day period beginning in 2005

The frequency of periodic follow-up cholinesterase tests is primarily a medical decision although the Rule requires at a minimum that employees be tested every 30 days that the above exposure thresholds are met.

The clinician should be flexible in designing a monitoring program and should consider the following factors in determining the frequency of cholinesterase testing:

- The extent and severity of potential exposure are major considerations. These will vary with the toxicity of the pesticides being used and the frequency with which they are handled. Different categories of work may involve different risks of exposure.
- The nature of the equipment being used may be an important factor. The institution of "closed systems" (e.g., water soluble packets and contained transfer systems) for mixing and loading pesticides has greatly reduced the exposure of the work force. Time spent mixing and loading using closed systems does not need to be counted in determining the need for periodic testing.
- Baseline and periodic testing is not required for employees whose sole exposure is limited to handling N-methyl-carbamate pesticides.
- The degree to which good work practices are followed will have an important effect on employee safety. Such practices include the use of the following: clean protective work

clothes, which are provided by employers and changed each day; showering before changing back to street clothes; proper use of gloves, boots, hats, and face shields; avoidance of eating, drinking, and smoking in pesticide-contaminated situations; and prompt and effective decontamination in the event of spills.

- The past history of an agricultural operation or of an individual is important. A company with well-maintained equipment, good discipline and work practices, and a long record of safety should require less intensive monitoring than one with a known record of employee poisoning. Even within one company, certain individuals may occasionally require more frequent testing on the basis of their previous work-related accident and injury history or their lack of experience.
- The clinician's experience and familiarity with a specific work force may be an additional consideration.
- Cholinesterase tests should be repeated any time employees become sick while working with cholinesterase-inhibiting agents or develops symptoms within 12 hours of their last exposure. Any suspected pesticide-related illness is a reportable condition and should be reported to DOH (1-360-236-3361 or 1-888-586-9427). If a worker dies within 24 hours of their last exposure to organophosphates, the clinician should attempt to arrange for a post-mortem cholinesterase test.

Treating and Reporting Pesticide Poisoning

How do I treat pesticide poisoning?
A plan for emergency care and transfer to an appropriate facility should be established. Staff should be trained to recognize symptoms of pesticide poisoning and be familiar with the facility's pesticide poisoning emergency management plan. The most important medications for treatment of toxicity from cholinesterase inhibition include atropine and protopam and should be present at emergency treatment sites. An excellent reference concerning the treatment of pesticide poisonings is the Environmental Protection Agency (EPA) publication Recognition and Management of Pesticide Poisonings. This is available free from the EPA. Order a printed version or download it at http://www.epa.gov/oppfod01/safety/healthcare/handbook/handbook.htm. (Available in both English and Spanish)

What is my responsibility to report pesticide illness and poisoning
Surveillance and reporting are essential to:

- Identify high-risk pesticides and use practices.
- Target intervention and prevention activities.
- Provide education and support for physicians and other health care providers. Pesticide-related illness is a reportable condition to the Washington State Department of Health (DOH) per WAC 246-10. All types of pesticide-related cases must be reported, including skin and eye injuries, systemic poisonings, suicides and homicides, and home and occupational exposures. A case seen as pesticide poisoning or as a condition suspected as pesticide-related may not be categorized as a "first-aid case" and must be reported.

  The legal requirements, or notifiable conditions, for disease reporting are the foundation for disease surveillance and are listed in Table 2.

Table 2: Washington State Surveillance and reporting requirements

PESTICIDES REPORTING REQUIREMENTS	Health care providers	Hospitals	Laboratories	Local health jurisdictions
HOSPITALIZED, FATAL, OR CLUSTER	Immediately notifiable to DOH Pesticide Program	Immediately notifiable to DOH Pesticide Program	No requirements for reporting	No requirements for reporting
OTHER	Notifiable within three work days to the DOH Pesticide Program	No requirements for reporting	No requirements for reporting	Educate health care providers regarding reporting requirements to the state
Telephone	800-222-1222 (Poison Center, by agreement for 24 hour access) or 888-586-9427 (DOH Monday-Friday 8:00am-5:00pm)			
Online	http://www.doh.wa.gov/notify/nc/pesticide.htm			

DOH Pesticide Program

Washington is one of eight states that actively tracks and investigates pesticide-related illnesses and is second only to California in the number of cases of pesticide poisoning investigated annually. From 1995 through 1999 the DOH investigated 1,163 cases of pesticides illness in the agricultural environment and 1,080 cases in the non-agricultural environment. Approximately 40% of all identified cases occurred among employees in agricultural settings.

Information about the DOH Pesticide Program can be found at www.doh.wa.gov/ehp/ts/Pest.htm

Tools for measuring pesticide exposure

Pesticide Exposure Interview Questions (adult and pediatric) can be found at www.doh.wa.gov/notify/other/pestinter.htm or

www.doh.wa.gov/notify/other/pestinter.pdf

Poisoning data and information about the DOH Pesticide Program can be found at www.doh.wa.gov/ehp/ts/Pest.htm

Related principles of occupational medicine

Mutual understanding between employers and clinicians
Employers are responsible for obtaining and paying for required medical monitoring. It is important that both clinicians and employers clearly understand their relationship and respective responsibilities. Employers may wish to engage medical services for a complete industrial medical program or they may wish to provide only the basic occupational health services required by state regulations.

Employers' expenses for a medical monitoring program are part of the "cost of production" for enterprises using hazardous materials. Agreement about services and costs are best arrived at through personal discussion. Clinicians may find it advisable to set their fees according to the amount of time and effort they estimate this monitoring will take rather than to charge solely on the basis of each patient visit or examination. Much of the work will be preventive, such as ordering and interpreting cholinesterase tests, and may not involve actual patient visits or examinations.

Occupational Health services
In their occupational health role, clinicians' responsibilities go beyond the familiar therapeutic doctor-patient relationship to include preventive and consultative functions for the individual workers and for employers' work forces as a group. These functions include the following:

- Clinicians should endeavor to be conversant with the work practices and exposures of the workers that they medically supervise. For this purpose it is good practice for them to visit the workplaces and obtain from employers a list of the compounds regularly used. The Washington State Department of Agriculture is also a good source of information on local pesticide practices but will not substitute for the exact information obtainable from the workplace. Valuable information on the toxicology of specific pesticides can be obtained from label and package inserts and from pesticide dealers and manufacturers.
- When clinicians decide to end their responsibility as medical monitors, they should notify employers in writing and allow enough time for employers to arrange for a replacement.

Confidentiality and Records
In occupational health practice, the clinician's goals and ethics are no different from those in other forms of medical practice except for the added responsibility to the employer. Their primary concern is the protection and maintenance of employees' health. According to the WAC 296-62-05209 and section 296-62-05201**, *"nothing in the rule is intended to affect existing legal and ethical obligations concerning the maintenance and confidentiality of employee medical information."*** (See http://www.leg.wa.gov/wac/index.cfm?fuseaction=Section&Section=296-62-05201.) The interpretation of this is that the clinician needs to disclose cholinesterase test results to the employer. However, all other employee medical information is to remain confidential.

This is in keeping with the HIPAA privacy rule of "minimum necessary" disclosure. The employer needs to know whether the employee's cholinesterase test results mean that the employer needs to institute work practices investigation or medical removal. The employer, or representatives not directly involved in providing occupational health services is limited only to access to written recommendations relating to occupational exposure. Other than test results and written recommendations, the employee must give specific written consent for release of any other information contained in the employee medical record. Washington state law prohibits unauthorized disclosure of personal medical information. The clinician may maintain test results for the employer.

In the program for monitoring pesticide exposure in Washington state, the employer's responsibility is to simply ensure, to the extent feasible, that medical information is maintained in a confidential manner and for the specified period of time by the designated health care provider.

Appendix A: Frequently asked questions

What is the cholinesterase monitoring program?
Cholinesterase monitoring is a surveillance program that follows agricultural employees who handle cholinesterase-inhibiting pesticides with the signal words **"Danger"** or **"Warning"** on the label. This is accomplished by periodically measuring cholinesterase activity levels and comparing the results to previously established baseline activity levels measured prior to exposure to these pesticides. These steps may include a review of the work practices, safety equipment, and employee pesticide handling practices, and for more severe inhibition, temporary removal of the employee from exposure.

Which employees are monitored?
Agricultural employees who "handle" toxicity Category I or II organophosphate OP) or N-methyl-carbamate pesticides with the signal words "**Danger**" or "**Warning**" are monitored. Handlers include mixers, loaders, applicators (both ground and aerial application), and flaggers.

Employees whose sole exposure is limited to handling N-methyl-carbamates are not required to undergo cholinesterase testing. But time spent handling N-methyl carbamates is counted toward the 50 hour per 30-day threshold if class I or II OP's are also handled.

Must employees participate in medical monitoring?
Yes, employees who may meet the handling exposure threshold must participate in medical monitoring by reporting for an initial clinic visit and discussing the risks and benefits of cholinesterase testing with the clinician. At that time the employee may choose to participate in the cholinesterase testing program or decline to participation. If the employee declines a signed declination statement is sent to the employer.

How do we monitor the employee with multiple employers?
An employee may handle cholinesterase-inhibiting pesticides for more than one employer. During the initial visit and whenever cholinesterase depression is detected the clinician may want to ask employees if they handle pesticides for another employer. Baseline test results are portable and a current baseline done through one clinician or for one employer may be used by another. Follow your current procedures for transfer of medical information.

Hours spent handling OP and N-methyl-carbamate pesticides are tracked by the employer only for that time the employee handled for that employer. Neither the clinician nor employers are required to document aggregate time an employee spends handling for multiple employers. The rule requires that occupational health recommendations are to be provided to the employer that has sent the employee in for testing. When an employee's cholinesterase level is depressed, it is recommended that the clinician inform the employee that work practices in all work places should be evaluated and that all exposure to cholinesterase-inhibiting pesticides should be avoided until cholinesterase levels return to within 20% of baseline.

What is the purpose of medical monitoring?
The purpose of medical monitoring is to prevent illness caused by exposure to OP and N-methyl-carbamate cholinesterase-inhibiting pesticides. By monitoring the employees' cholinesterase levels, illness can be prevented if a significant lowering or inhibition of their cholinesterase activity levels can be detected early, and they are removed from further exposure to cholinesterase-inhibiting pesticides before symptoms occur. Monitoring employees already removed from work for depressed cholinesterase levels will help determine when it will be safe for them to return to that work. Other benefits of monitoring are forced vigilance, increased worker and employer awareness of how toxic

these chemicals are, and development of a common goal of safe handling of highly toxic OP and N-methyl-carbamate pesticides.

Do other agricultural employees need medical monitoring?
If employees also mix, load, or apply toxicity category I or II OP and N-methyl-carbamate pesticides or are flaggers for 50 or more hours in any consecutive 30-day period (this threshold will be lowered to 30 or more hours beginning in 2005) then they will need medical monitoring. If the employees do not perform any of these tasks, then they do not need to be monitored because other means, suffice to prevent exposure, such as restricted entry intervals and pre-harvest intervals.

What are the pesticides with the signal words "Danger" and "Warning"
Pesticides labeled with the signal word "**Danger**" are in toxicity Category I and are highly and acutely toxic. Pesticides labeled with the signal word **"Warning**" are in toxicity Category II and are moderately acutely toxic. The employees requiring medical monitoring are those who handle organophosphate and N-methyl-carbamate pesticides, in these two more highly toxic categories, above predetermined exposure thresholds. Pesticides in Toxicity Categories III and IV are less toxic and are each labeled with the signal word **"Caution." (See** Cholinesterase-inhibiting pesticide products at **http://agr.wa.gov/PestFert/Pesticides/EmployeeProtection.htm#ProductList)**

Who is responsible for the medical monitoring?
The employer is responsible for setting up the medical monitoring program for his qualifying employees. This program requires the employer to maintain pesticide use records that identify the employee, the name of the pesticide, and the date of use. The employer is required to ensure that copies of employee test results and the clinician's written recommendations are maintained for seven years.

Who does the actual medical monitoring?
A physician or licensed health care professional contracted by the employer for this purpose does the actual medical monitoring. The employer is required to ensure that the clinician is familiar with the requirements of the rule. For example, by providing a copy of the rule or by confirming that the provider has attended training on cholinesterase monitoring.

What tests are done?
Blood is drawn to measure the enzymes plasma cholinesterase (also known as pseudo, serum, or butyrylcholinesterase) and red blood cell cholinesterase (also known as RBC, acetyl, or true cholinesterase).

Why are both the plasma cholinesterase and the RBC cholinesterase measured?
Although RBC cholinesterase is the same enzyme that is found at the neuro-effector site and thought to reflect inactivation there more accurately, it is more difficult to measure and is depressed more slowly than plasma cholinesterase. Some pesticides can preferentially lower the activity of either enzyme. For example, chlorpyrifos referentially lower plasma cholinesterase activity while phosmet and dimethoate preferentially lower RBC cholinesterase activity. Since each of these enzymes has different characteristics, measuring both will give a more accurate assessment of the cholinesterase activity level and, hence, any possible exposure.

How often are cholinesterase tests done?
The first tests are done to establish a baseline level in the employee prior to exposure to toxicity Categories I and II cholinesterase-inhibiting pesticides. Baseline tests should be done at least 30 days

since last exposure to organophosphate or N-methyl-carbamate pesticides. Once the baseline is established, periodic tests should be done according to one of the following schedules:

- On a routine 30-day basis during the application season

  OR

- Within three days at the end of each qualifying period where the employee meets the exposure threshold

Results of the periodic follow-up tests must be interpreted as a percentage of the employee's pre-exposure baseline level.

Can a clinician require more frequent testing than what is required by the regulations?
Yes. Neither the ***Guidelines*** nor the regulations are intended to constrain the exercise of sound medical judgment. The rule sets forth the *minimum* requirements and does not restrict clinicians from providing more intensive supervision. It is clearly stated in the regulations that the employer must *"follow any additional occupational health recommendations from the physician or LHCP."*

Can any laboratory do the cholinesterase tests?
No. The plasma and red blood cell cholinesterase tests ordered by the medical supervisor for occupational health surveillance must be done by the Washington State Department of Health Public Health Laboratory in 2004 and 2005. L&I will approve other laboratories beginning in 2006.

WA DOH Public Health Laboratory

1610 N.E. 150th Street

Shoreline, WA 98155-9701

Attention: Harold Ruark or Karin Kerr

Telephone: (206) 361-2800 • Fax: (206) 361-2904

http://www.doh.wa.gov/EHSPHL/PHL/default.htm.

How important is it to keep blood samples on ice?
Very important! Cholinesterase that is not fully "aged" in its inhibition with an organophosphate can reactivate spontaneously. In order to obtain accurate cholinesterase assay results, the blood samples must be cooled as soon as possible kept at 1º - 8ºC after drawing and should be shipped in cold-pack containers to the laboratory. ***Note*: *Full directions for shipping are on the reverse side of the test request form.***

Are there other factors of the testing procedure that can affect the test results?
Yes. One of these is the blood draw itself. The area from which the blood is drawn should be as clean as possible since even a small amount of pesticide contaminant can affect the results. Blood must be collected in one 5ml EDTA Tube and one 5ml or 7ml Red Top or Tiger Top tube. Specimens must be shipped by overnight mail, as testing must be done within 48 hours after collection. Full directions for collection and shipping are on the reverse side of the test request form. The assay method used can also affect the results. The Ellman technique for the assay is the approved testing methodology. The pesticide itself can preferentially affect one enzyme or the other. Other factors that can potentially affect the results are laboratory error, incorrect calculation of the percentage change from baseline, and poor record keeping and organization.

What is a baseline value?
The baseline is the plasma cholinesterase and RBC cholinesterase determinations that are measured at least 30-days prior to an employee's exposure to toxicity categories I and II cholinesterase-inhibiting pesticides.

How is the baseline value established?
All baseline tests should be taken when the employee has had no exposure to cholinesterase inhibitors for at least 30 days. If circumstances preclude the achievement of a 30-day exposure-free period, then a "working baseline" should be obtained after the longest practicable exposure-free period possible and a notation made in the medical record as to the date when the last exposure occurred. If subsequent tests show a rise in activity, this new higher level should be considered the new baseline. However, a 30-day exposure-free period from cholinesterase-inhibiting pesticides prior to obtaining the baseline tests is the best and preferred way to establish the most accurate baseline value.

Why is the baseline value important?
The baseline value is important because it is the level against which all subsequent post-exposure cholinesterase determinations are compared. Since the baseline value is determined before the employee is exposed and the periodic follow-up tests occur after exposure, it is assumed that any subsequent inhibition of the cholinesterase activity is due to exposure to these pesticides. All of the subsequent determinations must be interpreted as a percentage of the baseline value. If this percentage falls below certain thresholds, then certain actions are taken, including investigation of employee work and safety practices and equipment and removal of the employee from further exposure to these pesticides. Effective monitoring requires an accurate baseline.

Can a cholinesterase determination be compared to the laboratory normal levels instead of to a baseline value?
No. Laboratory "normal levels" can have a very wide range. If this wide range of cholinesterase activity levels were used instead of a baseline for comparison with the follow-up activity levels, it would be difficult, if not impossible, to determine if an individual's cholinesterase activity levels were actually depressed. In addition, a significant number of people will have normal baseline values that fall outside of the laboratory normal range. Therefore, the most accurate comparison would be to their own baseline value that was determined prior to any exposure to cholinesterase-inhibiting pesticides.

What are the levels of cholinesterase inhibition that trigger actions to be taken and what are these actions? Also, if an employee is removed from working with cholinesterase-inhibiting pesticides, when can this employee return to work with those pesticides?
After a baseline value is established, working season testing (periodic follow-up testing) is begun if the employee handles toxicity Category I or II cholinesterase-inhibiting pesticides for more than 50 hours or more in any consecutive 30-day period (starting in 2005 this threshold will move to 30 hours).

If either the follow-up plasma or RBC cholinesterase activity levels fall below 80% of baseline, 70% of RBC cholinesterase baseline, or 60% of plasma cholinesterase baseline, the following actions are triggered:

> **< 80% of the RBC or plasma cholinesterase baseline values:** Employer shall investigate the work practices of employees, including employee sanitation, pesticide handling procedures, and equipment usage, and conduct a review of safety equipment and its condition. Employers shall maintain a written record of the findings, changes in equipment or procedures, and any

recommendations made to the employee. Depression to this level is an indication for prompt retesting.

≤ 70% of RBC cholinesterase baseline value: Employer shall remove from exposure to cholinesterase-inhibiting pesticides employees whose RBC cholinesterase activity level falls below this level. Employees will not be allowed to return to work with these pesticides until their RBC cholinesterase and plasma cholinesterase activity levels each returns to 80% or more of baseline. Employers shall maintain written records of the date of removal and the date when the employee is returned to exposure.

≤ 60% of plasma cholinesterase baseline value: Employer shall remove from exposure to cholinesterase-inhibiting pesticides employees whose plasma cholinesterase level falls below this level. Employees will not be allowed to return to work with these pesticides until their plasma cholinesterase and RBC cholinesterase activity levels each returns to 80% or more of baseline. Employers shall maintain written records of the date of removal and the date when the employee is returned to exposure.

If employees cholinesterase activity levels are below the action levels, does it mean they cannot work at all?

No. Employees cannot work with cholinesterase-inhibiting pesticides until their cholinesterase activity levels (the RBC or plasma cholinesterase or both) recovers to 80% or more of the baseline values. Unless this employees have other work restrictions, they can work modified duty and do any other available work for which they are qualified.

If the cholinesterase activity levels are elevated, do employees have to be removed from further exposure to cholinesterase-inhibiting pesticides?

No. An elevation in cholinesterase activity levels is not an adverse effect of exposure to cholinesterase-inhibiting pesticides. A depression in cholinesterase activity levels is an adverse biological response of exposure to cholinesterase-inhibiting pesticides and is what the medical monitoring program is designed to detect. However, an elevation of cholinesterase activity over what was previously thought to be a baseline may indicate that the baseline was obtained during an unidentified exposure to a cholinesterase inhibitor.

Are there any medical or physical conditions other than exposure to organophosphates or N-methyl-carbamates that can affect cholinesterase levels?

Yes. Three per cent of the Anglo population has a genetically determined lower level of plasma cholinesterase. As plasma cholinesterase is the enzyme responsible for the metabolism of succinylcholine, these individuals have an increased susceptibility to this paralytic agent. There is no strong evidence indicating that these same individuals are more susceptible to organophosphates. This polymorphism does not affect RBC cholinesterase and these individuals should have normal activity levels of RBC cholinesterase. Plasma cholinesterase can also be lowered by liver disease, malnutrition, alcoholism, nephrotic syndrome, early pregnancy, cocaine, carbon disulfide, organic mercury, birth control pills, and metaclopramide.

RBC cholinesterase levels can be affected by hemolytic anemia, pernicious anemia, recovery from hemorrhage, and conditions associated with reticulocytosis.

Four cholinesterase-inhibiting drugs currently are approved by the U.S. Food and Drug Administration to treat people who have been diagnosed with Alzheimer's disease (AD). The medications are: Reminyl® (galantamine), Exelon® (rivastigmine), Aricept® (donepezil), and Cognex® (tacrine).

Why does a clinician have to interpret the results? Can't the lab or the employer by themselves look at the results themselves and determine if any action has to be taken?
On the surface, it appears as if it would not be difficult for the laboratory or an employer to interpret the test results. In reality, it is not so simple and requires a clinician to make the proper interpretation. A clinician has the clinical training, background, and experience to understand how other conditions can affect test results and how to put those factors in their proper context to arrive at the proper interpretation of the results. In addition, determining if an employee can work or not and how often to retest are clinical decisions. Furthermore, a clinician supervisor is required by the regulations.

What is the aim of this publication?
The main purpose of this document is to describe the steps to be taken to provide a program for medical monitoring of employees who regularly handle toxicity Categories I and II cholinesterase-inhibiting pesticides. The regulations cited in these Guidelines set forth the minimum state requirements and are not intended to constrain clinicians from exercising sound medical judgment or from providing more intensive medical supervision. These Guidelines also briefly mention certain aspects of prophylaxis, treatment of organophosphate and N-methyl-carbamate poisoning, and the requirement of clinicians to report all cases of pesticide poisoning to the Department of Health.

Who maintains the records for the medical monitoring program and for how long do these records have to be maintained?
The rule requires the employer to keep a record of the physician or clinician providing medical supervision, pesticide-handling records, all recommendations received from the medical supervisor, and all results of cholinesterase tests required to be made on their employees. It is required that these records be maintained for seven years and that they be accessible to the employee and their designated representative. Cholinesterase tests results may be maintained by the clinician on behalf of the employer.

If an employee has been made ill by pesticides at work, is the employee expected to see the clinician providing cholinesterase-monitoring services for diagnosis and treatment?
Not necessarily, the clinician with whom the employer has the agreement is only contracted to provide cholinesterase monitoring as set forth in WAC 296-307-148 and described in these Guidelines. Under this agreement, the medical supervisor is not required to provide emergency or other medical treatment. The medical monitor, the employer, and the employee can have other arrangements and agreements to provide diagnosis and treatment for occupational or other illnesses or injuries, in which case, the designated clinician would see this worker.

Are pesticide related illnesses reportable?
Yes. A clinician who knows or believes that a patient is suffering from a pesticide poisoning or any disease or condition caused by a pesticide shall promptly report that fact to the Washington Poison Center by telephone within 24 hours (1-800-222-1222). Poisoning from all pesticides, including the cholinesterase inhibitors, is reportable. Definitely diagnosed cases as well as suspected but not definitely diagnosed cases are reportable. http://www.doh.wa.gov/ehp/ts/PEST.HTM

If an employee is removed from exposure because their cholinesterase activity levels are 70% or less of the RBC cholinesterase or 60% or less of the plasma cholinesterase baseline levels, does this have to be reported? If it does, how, when, and to whom should it be reported?

If the removed worker is asymptomatic then this does not have to be reported to DOH. If the employee is ill with signs and symptoms consistent with or suspected to be a pesticide related illness (any pesticide including cholinesterase inhibiting ones), then this should be reported (See WAC 246-101-001 Notifiable Conditions).

Is there anything else the clinician, the employer, and the employee can do to implement and make the medical supervision program more effective?

It is strongly recommended that the clinician provide medical exams for each employee to be sure they are fit for the expected duties, be familiar with the pesticides used by the employers, and know the signs and symptoms caused by exposure to these pesticides.

It would be desirable for the employer to inform the clinician of the pesticides used in their operation, to explain medical monitoring to the employee, and to inform the clinician of the reason an employee was being seen. The employer is also required to provide employee training; to send in employees initial medical monitoring, baseline determinations and periodic testing; and to honor clinicians' recommendations and requests.

It would be desirable for the employee to present for baseline and working season testing, inform the employer of other exposures and of illness symptoms, and to follow the instructions of the clinician and the employer.

Is there any penalty for not following this rule correctly?

Clinicians are not responsible for ensuring employer and employee compliance with the rule. Employer citations for non-compliance with the rule will be determined in accordance with RCW 49.17 and WAC 296-800-350.

Appendix B. Sample Recommendation Form

HEALTH CARE PROVIDER RECOMMENDATIONS

To:_____
(Employer's Name)

Re:_____
(Employee's Name)

Cholinesterase testing on the above named employee was conducted on (Date)_____.

Cholinesterase level percentages based on comparison to baseline:

Red blood cell _____ Plasma_____

Occupational health recommendations:

1. [ ] No action required.

2. [ ] Your Pesticide Worker Protection Program must be evaluated and any potential exposures corrected.

3. [ ] The employee is to have a [ ] routine, or [ ] emergency laboratory test at:

_____ _____
(Clinic or laboratory) (Date/Time)

4. [ ] The employee is to be restricted from any further exposure to organophosphate and N-methyl-carbamate pesticides at least until he or she has reported to this office on (Date)_____ and until the employee's cholinesterase levels return to within 20% of baseline.

5. [ ] Other recommendations (specify): _____

The information contained on this form was telephoned [ ] provided verbally [ ] to the above named employer on (Date) _____

_____ _____
(Provider's signature) (Date)

Appendix C. Sample Informed Consent

FORM TO SAY 'YES' OR 'NO' TO THE BLOOD TESTS FOR PESTICIDE HANDLERS IN WASHINGTON STATE

This form may have words that you do not understand. You may take home a copy to think about or show to others. Please ask about any words or other things that are unclear.

You are here because you handle pesticides with the words "Danger" or "Warning" on the label. Because of a new safety law in Washington State, you must make a choice. You must choose to get the blood tests for pesticides or not. You must sign your name on this form to show your choice. Only you can make this choice.

WHAT HAPPENS AND WHY

To get these blood tests, you must get a "baseline" test and may also get one or more "follow-up" test. That means the first test (baseline) is taken when you have not handled pesticides for a while. After handling pesticides for at least 30 days, you may get another test (follow-up). How often you get tested depends on how much pesticide you handle.

- The purpose of these tests is to help prevent sickness because of dangerous pesticides.
- By law, your employer must make sure that you can get the blood tests when they are required but only if you choose to have blood tests.
- You pay nothing for the blood tests.
- Your employer and Washington State will pay for all costs.

Every time you get the blood test, a medical worker will take about 2 tablespoons of blood from a vein in your arm. This blood will go into two small tubes. The worker will use a sterile needle to take the blood. This part takes about 5 minutes. Then you will wear a Band-Aid on your arm for a few hours.

TEST RESULTS

The tests could show that you have gotten too much pesticide in you body. If so, you may have to stop all contact with pesticides for up to 3 months while you get better. Or, they could show you are fine and you can continue work as usual.

Your doctor will send the blood to and get the results of each test from the Department of Health. Then he will know if you have gotten too much dangerous pesticide in your body. The doctor or his worker will tell you and your employer what the results mean and what to do next. The Department of Health may also share information about test results with the Department of Labor & Industries but you will not be identified. You should ask the medical people if you want to know more about any of these things.

OTHER KINDS OF TREATMENT

You will choose to get these blood tests or not to get them. There are no other choices.

RISKS

The risks to your body from getting these blood tests are the risks of a needle stick. You might feel pain or get a bruise. You could feel a little dizzy. Once in a while, someone

faints. Rarely, someone gets an infection. As with all laboratory tests, there could be a mistake in the way the test is done. These risks are small.

Some people are afraid of blood. Others are afraid of needles. If you are one of these people, you may feel uncomfortable about getting the blood tests. Taking the blood test is your choice.

You might worry that your employer will fire you because of these tests. You might worry about losing your benefits or getting your wages cut. You might have other worries. For example, you might worry that your employer will know about the test results. Or, you might worry that you will get sick from dangerous pesticides if you do not get the test. Feel free to talk to the health worker about any serious worries you have.

BENEFITS

These tests may help you to avoid sickness from pesticides. They will help you find out if you have too much pesticide in your body. They may help you and your employer make better use of safety equipment. Do you know how well your respirator and other PPE work, the test will help you know they are protecting you. The law says you cannot be fired because of the blood tests. Also, it says your employer cannot cut your pay or benefits because these tests show you need to avoid work with these pesticides. He must continue your usual pay and benefits until you can work with these pesticides again, up to a maximum of 3 months.

QUESTIONS

If you have any other questions you can call the Washington State Department of Labor and Industries at 1-800-4BE-SAFE. Information is available in Spanish.

FORM TO SAY "YES" (GIVE CONSENT) TO THE BLOOD TESTS

I have read this form (or had it read to me). I have talked about the blood tests with the medical person my employer sent me to see. YES, I CHOOSE TO GET THE BLOOD TESTS. I have had a chance to ask questions. For any other questions, I can call **1-800-4BE-SAFE.**

_____	_____
Employee's Name (Print)	Witness Name (Print)
_____	_____
Employee's Signature	Witness Signature
Date: _____	Date: _____

---Complete the following only if form is read to participant---

I confirm that the information in this consent form and any other written information was accurately explained to, and apparently understood by, the participant. The participant freely consented to participate in the blood test program.

_____ _____

Witness Name (Print) Witness Signature

Date: _____

Copies to: Licensed Health Care Provider, Participant

FORM TO SAY "NO" TO (DECLINE) THE BLOOD TESTS
(Cholinesterase Monitoring Blood Test Declination Form)
Use with Chapter 296-307-148 WAC, Cholinesterase Monitoring

Employer: _____

I work with dangerous pesticides with the words "Danger" or "Warning" on the label. Their chemical names are "Organophosphates" or "Carbamates". I can get blood tests to tell if I have gotten too much pesticide in my body. I do not have to pay for the cost of these blood tests. My employer and Washington State will pay.

To get these blood tests, I must get them more than once. I must get a "baseline" test and a "follow-up" test. How often I get tested depends on how much pesticide I handle. The tests might show that I have too much pesticide in my body. If so, I may not be allowed to handle pesticides for a short time while I get better. During that time, my employer must continue my usual pay and benefits. He must do so for up to 3 months. This is what the law says.

I have talked about the blood tests with the medical person my employer sent me to see. I have talked about the risks and benefits of the tests. I have decided NOT to get the blood tests now. If I change my mind and want to get the blood tests another time, that is OK too. If I choose to do that, I can still get them another time without cost.

_____	_____
Employee's Name (Print)	Witness Name (Print)
_____	_____
Employee's Signature	Witness Signature
Date: _____	Date: _____

---Complete the following only if form is read to participant, or audiotape is used---

I confirm that the information in this consent form and any other written information was accurately explained to, and apparently understood by, the participant. The participant freely declined to participate in the blood test program.

_____	_____
Witness Name (Print) /Date	Witness Signature /Date

Copies to: Licensed Health Care Provider's file, Participant

Appendix D. Sample Declination

Cholinesterase Monitoring (blood test) Declination Form

Employer: _____

_____

I understand that because I work with certain dangerous pesticides*, I can get blood tests to tell if I have too much pesticide in my body. I also understand that I do not have to pay for these blood tests, my employer will provide the tests at no cost to me.

I have talked with a medical provider about the blood tests and the benefits and possible disadvantages of participating in the cholinesterase blood test program. I know that if the medical provider recommends that I stop handling these pesticides for a short period of time, the law says my employer must continue to provide my pay and benefits for up to 3 months or until I am allowed to return to work with these pesticides.

I have decided not to take the blood tests. I understand that if I change my mind and decide to have the blood tests, my employer will provide the tests at no cost to me.

_____

_____

Employee's Name (Print) Medical Provider Signature (Witness)

_____ _____

Employee's Signature Date

_____

Date

*Organophosphate and N-methyl-carbamate pesticides with the words **Danger** or **Warning** on the label.

Appendix E. Sample medical monitor agreement form

SAMPLE FORM LETTER AND AGREEMENT

Dear Mr./Ms. _____ Address: _____

_____

This letter is in response to your request that I provide medical supervision to those of your employees requiring such supervision, as described in the L&I Cholinesterase Monitoring Rule (WAC 296-307-148).

In agreeing to provide medical monitoring, I expect your agreement to abide by the provisions of the Cholinesterase Monitoring Rule and I intend to perform my functions in accordance with the specified *Guidelines* provided by L&I.

The employees covered by this regulation are employees who handle organophosphate and N-methyl-carbamate pesticides with the signal word “DANGER” or “WARNING” on the label. In 2004 employees who handle these pesticides for 50 or more hours in any consecutive 30-day period require medical monitoring. In 2005 this exposure threshold will change to handling 30 or more hours in any consecutive 30-day period.

It is your responsibility to have that employee come to me for an initial evaluation. If the employee agrees to participate in the cholinesterase-testing program it is your responsibility to send the employee for periodic cholinesterase testing. Employees will be required to have their baseline retested, or verified, every year.

According to the Rule, the employer shall ensure that periodic cholinesterase testing is conducted at least every 30 days that he employee meets the testing exposure threshold and at least as frequently as recommended by the medical supervisor. I may schedule more frequent tests as necessary, according to the test results.

With mutual cooperation we should be able to assure your employees a safe work situation.

_____ _____

(Signature) (Date)

_____ _____

(Address) (Telephone)

Appendix F. Initiation of medical monitoring

INITIATION OF MEDICAL MONITORING

NOTIFICATION BY EMPLOYER TO PHYSICIAN
REGARDING NEW EMPLOYEE TO BE MONITORED.

Employer_____

Address_____

Employee_____ Job Title_____

Employee date of birth_____

Address and Phone_____

To (clinic or health care provider)_____

The above named employee will begin handling organophosphate or N-methyl-carbamate pesticides, beginning on (approximate date)_____.

Payment to you for clinical services is guaranteed.

_____ _____

(Employer Signature) (Date)

Appendix G. Employee no longer requires medical monitoring

NOTIFICATION THAT EMPLOYEE NO LONGER REQUIRES MEDICAL SUPERVISION

To (Clinic or health care provider)_____

Employee name_____

Employee date of birth_____

The above named employee is no longer employed by me [ ] or is no longer involved in regularly handling organophosphate or N-methyl-carbamate pesticides with the signal words "DANGER" or "WARNING" [ ].

Employer_____

Signed by_____

Title_____

Date effective_____

Appendix H. Cholinesterase monitoring information

CHOLINESTERASE MONITORING INFORMATION

Type of work*	Pesticides used	Exposure threshold
Mixing, loading, and applicating, handling open containers, disposing of pesticides, maintaining contaminated equipment	Organophosphates and N-methyl-carbamates with the word "DANGER" or "WARNING" on label (Category I or II).	50 or more hours in any consecutive 30-day period. (In 2005 this changes to 30 or more hours)

** See defintion of "handler: in WAC 296-307-11005*

REQUIRED FREQUENCY OF BLOOD CHOLINESTERASE TESTING

Employee who meet handling exposure threshold	Frequency of testing
New Employee	Establish employee participation. Baseline testing 30-days after employee last handled cholinesterase-inhibiting pesticides.*
Periodic testing	Test once in every 30-day period or whenever the exposure threshold is met (but no more often than every 30 days).**
Follow-up testing	Retesting after significant RBC cholinesterase depression should be scheduled based on a 1%/day regeneration rate. Retesting after significant plasma cholinesterase depression may be conducted within 24 hours

**Employees whose exposure is limited to-N-methyl-carbamates are exempt from baseline and periodic test requirements.*

***Hours spent mixing and loading using closed systems (e.g. water-soluble packets) are not counted in the determination for periodic testing.*

Appendix I. Laboratory requisition slip

PUBLIC HEALTH LABORATORIES

1610 NE 150th St., Seattle, WA 98155-9701

(206) 361-2898

Please print clearly. Missing information may delay test order.

A. PATIENT NAME: First :

Middle: Last:

B. DATE OF BIRTH (mm/dd/yyyy): ___ ___ / ___ ___ / ___ ___ ___ ___

C. PLACE OF BIRTH: State/Province _____

Country _____

D. GENDER: ☐ Male ☐ Female ☐ UNK

E. ETHNICITY: ☐ Latino/Hispanic ☐ Not Latino/Hispanic ☐ UNK

F. MOTHER'S MAIDEN NAME:

First : Last:

H. NAME OF CLINICIAN ORDERING TEST:

First : Last :

I. PHONE NUMBER FOR RECEIVING RESULTS:

Tel: (_____) _____ - _____ ext. _____ **OR**

Fax: (_____) _____ - _____ ext. _____

J. CLINIC INFORMATION: Name _____

Street / P.O. Box: _____

City: _____ State: _____ Zip: _____

Tel: (_____) _____ - _____ ext. _____

G1. MONITORING STAGE: Has a specimen been sent in for Cholinesterase testing for this patient before?
☐ Yes (go to **G2**) ☐ No (go to **H**.) ☐ UNK (go to **H**)

G2. If Yes, is this order for a: ☐ Follow up test ☐ Additional baseline

G3. [Optional, for clinician's use] Previous baseline: RBC _____ Serum _____

K. PATIENT'S EMPLOYER: Company _____ Contact Name: First _____ Last_____ Tel: (_____) _____ - _____ ext. _____

EMPLOYER ADDRESS: Street / P.O. Box_____ City: _____ State: __WA__ Zip: _____

L. INFORMATION ABOUT SPECIMEN DRAW (to be completed at time of draw):

DATE AND TIME SPECIMEN DRAWN: Date ___ ___ / ___ ___ / ___ ___ ___ ___ Time: _____ **:** _____ am / pm (circle one)

NAME OF PHLEBOTOMIST: First: Last:

FOR LABORATORY USE ONLY (Do not write below this line)

LAB ACCESSION NO.	DATE RECEIVED: __ __ / __ __ / __ __ __ __	DATE ANALYZED: __ __ / __ __ / __ __ __ __ TIME ANALYZED: __ __ : __ __ am / pm (circle one)	ANALYST:

SPECIMEN RESULTS

METHOD: Ellman / Auto Analyzer / Roche Kit **DATE OF REPORT:** __ __ / __ __ / __ __ __ __

☐ Correction to prior results.

Date of Report for prior results:

_____ /_____ / _____

Prior Results:

RBC _____

Serum _____

ChE in RBC: _____µMol/min/gHb RBC Normal Range: _____µMol/min/gHb

ChE in Serum: _____µMol/min/mL Serum Normal Range: _____µMol/min/mL

NOTES:

SUPERVISOR:

Appendix J: Instructions for Collecting and Shipping Blood Specimens, Whole Blood and Serum, for Cholinesterase Test

COLLECTION

1. Blood should be collected only by trained personnel using aseptic methods and working under the direction of a qualified, licensed practitioner.
2. Use only plastic vacutainer tubes to avoid breakage while shipping specimens. Please contact the WA DOH Public Health Laboratories (PHL) at 206-361-2894 if you do not have recommended tubes at your facility.
3. For each patient:
    - Collect 5 ml of whole blood into EDTA tube (Lavender top, # BD-367-863).
    - Collect an additional 5 or 7 ml of whole blood into Red top or Red/Gray "Tiger Stripe" tube (#BD-367-986).
    - Use 21gauge needle to minimize mechanical damage of red blood cells (RBC).
    - If patient is sent to the Phlebotomist directly from the area of pesticide application, thoroughly swab the area of venipuncture to preclude contamination of the blood specimen with possible skin-surface pesticide.
    - Label each tube with the patient's full name.
    - Fill out the Cholinesterase (ChE) Test Request Form with as much patient information as possible. Correct and complete specimen identification is essential for data integrity.
4. The blood collected in Red Top or Tiger Stripe tube is used for preparation of serum specimen. It is important for the integrity of ChE results to separate serum from red blood cells as soon as possible after blood collection to minimize hemolysis of red blood cells. If your clinic has a centrifuge to spin down blood, you can use either the Red Top or Tiger Stripe tube for blood collection. Make sure that blood is properly clotted (wait 15-30 minutes if needed), then spin it down at 2,000 RPM for 5 minutes and draw serum off into a plastic or plastic coated glass tube for shipment. If your clinic does not have a centrifuge, you should use only the Tiger Stripe tube for collecting blood for serum specimen. This tube contains a clot separator assembly that minimizes hemolysis during the specimen transportation.
5. Gently rock the EDTA (Lavender top) tube for about 45 seconds to fully mix the whole blood and EDTA.
6. Prepared whole blood specimen (Lavender top tube) and serum specimen must be refrigerated at 1ºC to 4º C until they are cold-packed for shipping to PHL.

NOTE: Specimens are to be collected on Sundays through Thursdays. DO NOT collect specimens on Fridays or Saturdays because the laboratory will not be performing tests on Saturdays or Sundays.

SHIPPING

1. **Specimens must be tested within 48 hours after the time of collection in order to maintain analytical integrity for this enzyme assay. Therefore, specimens must be shipped and received by PHL within 24 hours of collection**.
2. Pack properly identified serum and whole blood samples with enough ice gel packing to keep specimens at 1º to 8ºC (34 – 46º F) for 24 hours. Use Diagnostic Shipping System package provided by Thermal Isolating Systems (ThermoSafe) to ship 8-16 tubes. This package consists of a mailer, model 341, for shipping 8 tubes, an insulated container, with inside dimensions of 11"x 8" x 8", and one or two pound gel packs. This system should keep specimens of blood within the desired temperature of 2ºC to 8ºC for 24 hours. Other shipping systems can be used if labeled as Diagnostic Shipping System and meet requirements on keeping specified temperature during 24 hours and secure tubes from motion within a container.
3. Place a tube filled with water into a package so the temperature inside a shipping package can be measured upon arrival at PHL.
4. Secure specimens tightly in the mailer to avoid unnecessary motion of the tubes since hemolysis in transit is problematic for the cholinesterase procedure.
5. Ship specimens with courier or mail carrier with guaranteed NEXT DAY delivery to: **WA DOH Public Health Laboratory, 1610 N.E. 150 Street, Shoreline, WA 98155-9701, attention to Harold Ruark or Karin Kerr.**

CRITERIA FOR SPECIMEN REJECTION

1. Specimen tube is broken or leaking.
2. Specimen is not delivered to PHL within 24 -36 hours from time of collection.
3. Specimen arrives at PHL at temperature higher than 10ºC.

If you have questions about ChE blood specimen collection and shipment please contact **Harold Ruark** (206/361-2898) or **Marina Silverstone** (206/361-2894).

Listed below is the order contact information and part number information for the Thermal Isolating Systems (ThermoSafe) shipping container If you have any questions please contact Manny Cardet at 800-870-7225 or via e-mail at cardetm@juno.com.

Insulated Container - Part Number 11080802

Shipping Mailer - Part Number 472

Gel Pack (24 ounce) - Part Number 0024

Thermal Insulated Systems

1075 Lambert Road

Unit # B

Brea, California 92821